CLAIMS

1. A nanocomposite magnet having a composition represented by the general formula: $R_xQ_yM_z(Fe_{1-m}T_m)_{bal}$, where R is at least one rare-earth element, Q is at least one element selected from the group consisting of B and C, M is at least one metal element that is selected from the group consisting of Al, Si, Ti, V, Cr, Mn, Cu, Zn, Ga, Zr, Nb, Mo, Ag, Hf, Ta, W, Pt, Au and Pb and that always includes Ti, T is at least one element selected from the group consisting of Co and Ni, and the mole fractions x, y, z and m satisfy the inequalities of

$6\ at\% \leqq x < 10\ at\%$,

$10\ at\% \leqq y \leqq 17\ at\%$,

$0.5\ at\% \leqq z \leqq 6\ at\%$ and

$0 \leqq m \leqq 0.5$, respectively,

the nanocomposite magnet including a hard magnetic phase and a soft magnetic phase that are magnetically coupled together,

wherein the hard magnetic phase is made of an $R_2Fe_{14}B$-type compound, and

wherein the soft magnetic phase includes an α-Fe phase

and a crystalline phase with a Curie temperature of 610 ℃ to 700 ℃ as its main phases.

2. The nanocomposite magnet of claim 1, wherein 6 at% $\leqq$ x $\leqq$ 8 at%, and

wherein the crystalline phase included in the soft magnetic phase has a Curie temperature of 610 ℃ to 650 ℃.

3. The nanocomposite magnet of claim 1 or 2, wherein Ti accounts for 0.25 at% to 6 at% of the overall magnet.

4. The nanocomposite magnet of claim 1 or 2, wherein the content of the crystalline phase included in the soft magnetic phase is greater than that of an Fe_3B-type compound phase.

5. The nanocomposite magnet of claim 1 or 2, wherein the $R_2Fe_{14}B$-type compound phase has an average grain size of 10 nm to 70 nm, and

wherein a soft magnetic phase with an average grain size of 1 nm to 10 nm is present on the grain boundary of the

$R_2Fe_{14}B$-type compound phase.

6. A rapidly solidified alloy to make a nanocomposite magnet, the alloy having a composition represented by the general formula: $R_xQ_yM_z(Fe_{1-m}T_m)_{bal}$, where R is at least one rare-earth element, Q is at least one element selected from the group consisting of B and C, M is at least one metal element that is selected from the group consisting of Al, Si, Ti, V, Cr, Mn, Cu, Zn, Ga, Zr, Nb, Mo, Ag, Hf, Ta, W, Pt, Au and Pb and that always includes Ti, T is at least one element selected from the group consisting of Co and Ni, and the mole fractions x, y, z and m satisfy the inequalities of

$6\ at\% \leqq x < 10\ at\%$,

$10\ at\% \leqq y \leqq 17\ at\%$,

$0.5\ at\% \leqq z \leqq 6\ at\%$ and

$0 \leqq m \leqq 0.5$, respectively,

wherein the alloy includes an $R_2Fe_{14}B$-type compound, an α-Fe phase, and a crystalline phase with a Curie temperature of 610 ℃ to 700 ℃.

7. The rapidly solidified alloy of claim 6, wherein 6 at%≦x≦8 at%, and

wherein the crystalline phase included in a soft magnetic phase has a Curie temperature of 610 ℃ to 650 ℃.

8. A method of making a rapidly solidified alloy as a material for a nanocomposite magnet, the method comprising the steps of:

preparing a molten alloy having a composition represented by the general formula: $R_xQ_yM_z(Fe_{1-m}T_m)_{bal}$, where R is at least one rare-earth element, Q is at least one element selected from the group consisting of B and C, M is at least one metal element that is selected from the group consisting of Al, Si, Ti, V, Cr, Mn, Cu, Zn, Ga, Zr, Nb, Mo, Ag, Hf, Ta, W, Pt, Au and Pb and that always includes Ti, T is at least one element selected from the group consisting of Co and Ni, and the mole fractions x, y, z and m satisfy the inequalities of

6 at%≦x≦8 at%,

10 at%≦y≦17 at%,

0.5 at%≦z≦6 at% and

$0 \leqq m \leqq 0.5$, respectively, and

quenching the molten alloy by bringing the molten alloy into contact with the surface of a rotating chill roller, thereby forming a rapidly solidified alloy,

wherein the step of quenching includes adjusting a quenching rate within the range of 2.2×10^5 K/s to 2.8×10^5 K/s when the surface temperature of the alloy decreases from 900 ℃ to 700 ℃.

9. A method of making a rapidly solidified alloy as a material for a nanocomposite magnet, the method comprising the steps of:

preparing a molten alloy having a composition represented by the general formula: $R_xQ_yM_z(Fe_{1-m}T_m)_{bal}$, where R is at least one rare-earth element, Q is at least one element selected from the group consisting of B and C, M is at least one metal element that is selected from the group consisting of Al, Si, Ti, V, Cr, Mn, Cu, Zn, Ga, Zr, Nb, Mo, Ag, Hf, Ta, W, Pt, Au and Pb and that always includes Ti, T is at least one element selected from the group consisting of Co and Ni, and the mole

fractions x, y, z and m satisfy the inequalities of

8 at% $< x <$ 10 at%,

10 at% $\leqq y \leqq$ 17 at%,

0.5 at% $\leqq z \leqq$ 6 at% and

$0 \leqq m \leqq 0.5$, respectively, and

quenching the molten alloy by bringing the molten alloy into contact with the surface of a rotating chill roller, thereby forming a rapidly solidified alloy,

wherein the step of quenching includes adjusting a quenching rate within the range of 2.2×10^5 K/s to 4.5×10^5 K/s when the surface temperature of the alloy decreases from 900 ℃ to 700 ℃.

10. The method of claim 8 or 9, wherein the step of quenching includes adjusting a quenching rate at 4.0×10^5 K/s or more when the surface temperature of the alloy decreases from 1,300 ℃ to 900 ℃.

11. The method of claim 8, wherein the step of quenching includes making a crystalline phase, included in the rapidly

solidified alloy, account for more than 50 vol% of the entire rapidly solidified alloy.

12. A method for producing a nanocomposite magnet, the method comprising the steps of

making a rapidly solidified alloy by the method of one of claims 8 to 11, and

thermally treating the rapidly solidified alloy, thereby forming a nanocomposite structure in which hard magnetic phases of an $R_2Fe_{14}B$-type compound and soft magnetic phases, consisting essentially of an α-Fe phase and a crystalline phase with a Curie temperature of 610 ℃ to 650 ℃, are magnetically coupled together.

13. A decision method for a nanocomposite magnet, the method comprising the steps of:

preparing multiple rapidly solidified alloys as materials for a nanocomposite magnet, each said alloy having a composition represented by the formula: $R_xQ_yM_z(Fe_{1-m}T_m)_{bal.}$, where R is at least one rare-earth element, Q is at least one

element selected from the group consisting of B and C, M is at least one metal element that is selected from the group consisting of Al, Si, Ti, V, Cr, Mn, Cu, Zn, Ga, Zr, Nb, Mo, Ag, Hf, Ta, W, Pt, Au and Pb and that always includes Ti, T is at least one element selected from the group consisting of Co and Ni, and the mole fractions x, y, z and m satisfy the inequalities of

$6\ at\% \leqq x < 10\ at\%$,

$10\ at\% \leqq y \leqq 17\ at\%$,

$0.5\ at\% \leqq z \leqq 6\ at\%$ and

$0 \leqq m \leqq 0.5$, respectively, and

determining whether or not a rapidly solidified alloy to make a nanocomposite magnet, which has been selected from the multiple rapidly solidified alloys, includes a soft magnetic phase having a Curie temperature of 610 ℃ to 700 ℃.

14. The method of claim 13, wherein $6\ at\% \leqq x \leqq 8\ at\%$, and

wherein the crystalline phase included in the soft magnetic phase has a Curie temperature of 610 ℃ to 650 ℃.

15. The method of claim 14, wherein the step of determining includes subjecting the rapidly solidified alloy to make a nanocomposite magnet to thermogravimetry.

16. A nanocomposite magnet having a composition represented by the general formula: $R_xQ_yM_z(Fe_{1-m}T_m)_{bal}$, where R is at least one rare-earth element, Q is at least one element selected from the group consisting of B and C, M is at least one metal element that is selected from the group consisting of Al, Si, Ti, V, Cr, Mn, Cu, Zn, Ga, Zr, Nb, Mo, Ag, Hf, Ta, W, Pt, Au and Pb and that always includes Ti, T is at least one element selected from the group consisting of Co and Ni, and the mole fractions x, y, z and m satisfy the inequalities of

$6\ at\% \leqq x < 10\ at\%$,

$10\ at\% \leqq y \leqq 17\ at\%$,

$0.5\ at\% \leqq z \leqq 6\ at\%$ and

$0 \leqq m \leqq 0.5$, respectively,

the nanocomposite magnet including a hard magnetic phase and a soft magnetic phase that are magnetically coupled together,

wherein the hard magnetic phase is made of an $R_2Fe_{14}B$-type compound, and

wherein the soft magnetic phase includes an α-Fe phase and an Fe_3B phase as its main phases.

17. The nanocomposite magnet of claim 16, wherein 6 at% $\leqq x \leqq$ 8 at%.

18. A rapidly solidified alloy to make a nanocomposite magnet, the alloy having a composition represented by the general formula: $R_xQ_yM_z(Fe_{1-m}T_m)_{bal}$, where R is at least one rare-earth element, Q is at least one element selected from the group consisting of B and C, M is at least one metal element that is selected from the group consisting of Al, Si, Ti, V, Cr, Mn, Cu, Zn, Ga, Zr, Nb, Mo, Ag, Hf, Ta, W, Pt, Au and Pb and that always includes Ti, T is at least one element selected from the group consisting of Co and Ni, and the mole fractions x, y, z and m satisfy the inequalities of

6 at% $\leqq x <$ 10 at%,

10 at% $\leqq y \leqq$ 17 at%,

0.5 at% $\leqq z \leqq 6$ at% and

$0 \leqq m \leqq 0.5$, respectively,

wherein the rapidly solidified alloy includes an $R_2Fe_{14}B$-type compound, an α-Fe phase and an Fe_2B phase.

19. The rapidly solidified alloy of claim 18, wherein 6 at% $\leqq x \leqq 8$ at%.